

CLAIMS

1. A method of detecting fast neutrons of energy greater than 5MeV comprising the steps of:

5 providing a neutron detector comprising a plate having a plurality of microchannels or like detection sites disposed thereon which produce an electron output;

10 directly coupling said neutron detector to an electron detector without an intermediate scintillator layer;

positioning the neutron detector so that neutrons are incident on said neutron detector; and

15 detecting the output of the electron detector.

2. A method according to claim 1 in which the neutron detector is a microchannel plate.

20 3. A method according to claim 1 in which the neutron detector is a microsphere or microfibre plate.

4. A method according to any of claims 1 to 3 in which the area of the neutron detector upon which the detected neutrons are incident is greater than $1.0 \times 10^{-2} \text{m}^2$, preferably greater than $5.0 \times 10^{-2} \text{m}^2$, more preferably greater than $5.0 \times 10^{-1} \text{m}^2$, most preferably greater than $6.0 \times 10^{-1} \text{m}^2$.

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5. A method according to any of claims 1 to 4 in which the electron detector is without an entrance window, thereby permitting direct accumulation of electron charge from the neutron detector on the electron detector.
- 5 6. A method according to any previous claim in which the electron detector comprises a pixel array detector.
7. A method according to claim 6 in which the electron detector comprises an amorphous silicon or an amorphous selenium pixel array detector.
- 10 8. A method according to any previous claim in which the neutron detector comprises greater than 45% by weight of silicon, preferably greater than 90%.
9. A method of detecting and imaging neutrons according to any previous claim, in which the step of detecting the output of the electron detector comprises assembling
15 outputs from different discrete areas of the electron detector in order to produce an image of neutrons incident on said neutron detector.
10. A method according to any previous claim in which the neutron detector
20 comprises an array of individual plate devices.
11. A detection device for detecting radiation such as neutrons and X-rays comprising a neutron detector directly coupled to a pixel array electron detector, in which the radiation detector comprises a plate having a plurality of microchannel or like detection
25 sites disposed thereon which produce an electron output, and the radiation detector is directly coupled to the electron detector without an intermediate scintillator layer.

12. A device according to claim 11 in which the radiation detector is a microchannel plate.

13. A device according to claim 11 in which the radiation detector is a
5 microsphere or microfibre plate.

14. A device according to any of claims 11 to 13 in which the electron detector is an amorphous silicon or amorphous selenium pixel array detector.

10 15. A device according to any of claims 11 to 14 in which the electron detector is without an entrance window thereby permitting direct accumulation of electron charge from the radiation detector on the electron detector.

15 16. A device according to any of claims 11 to 15 in which the radiation detector has a front face upon which radiation is incident, and the surface area of said front face is greater than $1.0 \times 10^{-2} \text{m}^2$, preferably greater than $5 \times 10^{-2} \text{m}^2$, more preferably greater than $5.0 \times 10^{-1} \text{m}^2$, most preferably greater than $6.0 \times 10^{-1} \text{m}^2$.

20 17. A device according to any of claims 11 to 16 for imaging radiation such as neutrons and X-rays, the device further comprising imaging means for assembling outputs from different discrete areas of the electron detector in order to produce an image of radiation incident on said radiation detector.

25 18. Use of a device according to any of claims 11 to 17 to image neutrons.

19. Use according to claim 18 to image fast neutrons of energy greater than 5MeV.

20. Use in the imaging of fast neutrons of energy greater than 5MeV of a device comprising a neutron detector directly coupled to an electron detector without an intermediate scintillator layer, the neutron detector comprising a plate having a plurality of microchannels or like detection sites disposed thereon which produce an electron output.